equal to the velocity acquired by a heavy body in falling vertically *in vacuo*, under the action of gravity, through half the mean depth of the water. Now, it is highly probable, that, notwithstanding the variable density of the atmosphere with altitude above the surface of the earth, the same formula is applicable to long gravity-waves propagated in it; viz., that the velocity of the wave is equal to that which a heavy body would acquire in falling vertically through half the height of a homogeneous atmosphere.

It is likewise well known, that the illustrious Newton (Principia, book ii. prop. 49), neglecting the influence of the thermal changes incident to the propagation of aerial elastic waves, deduced a most remarkable but imperfect formula for the velocity of sound in air, making it equal to that which a heavy body would acquire in falling vertically through half the height of a homogeneous atmosphere whose weight or pressure measures its elasticity.

It will be noticed that the velocity of sound by Newton's formula is precisely the same as that given by the hydrodynamical formula for long aerial gravity-waves. It is true, that, in consequence of the heat momentarily developed or absorbed during the condensations and rarefactions of the air, the actual velocity of sound exceeds that computed by the Newtonian formula by about one-sixth (a correction of the formula supplied by Laplace); yet the approximation is sufficient to seemingly co-ordinate the velocities of these diverse kinds of aerial waves.

Thus, the height of a homogeneous atmosphere, under standard conditions, being 7,990 metres, the velocity of sound computed by the Newtonian formula equals 279.96 metres per second at 0° C., and 293.5 metres per second at the August temperature of 27° C. The actual velocity of sound at above-indicated temperatures equals 332.5 and 348.6 metres per second respectively.

On the other hand, the following are some of the estimates that have been made of the velocity of the Krakatoa atmospheric waves:—

		Velocity in metres per second.
Gen. Strachey	in England	301.3 to 315.0
Professor Förster . . .	at Berlin	278.0
Mr. Renou	at Paris	246.0 to 278.0
Mr. Renou	in France	305.0 to 319.0
Mr. Wolf	at Paris	325.8
Mr. Baillaud	at Toulouse . . .	324.0
Mr. Hall	at Jamaica	308.5

All of these estimates fall decidedly short (as theory indicates) of the actual velocity of sound in air; and most of them approximate somewhat more nearly to the velocity computed by the Newtonian formula, which, as we have seen, corresponds with the hydrodynamical formula for long aerial gravity-waves.

Considering the inherent difficulties of the precise determination of the several data requisite for deducing the true velocity of the atmospheric waves originating at Krakatoa on this occasion, we need not be astonished at the considerable divergence in the estimates, or that the assumed exact coincidence of velocities of the two kinds of aerial waves fails to be verified in an accurate manner, either by theory or by observation.

JOHN LECONTE.

Berkeley, Cal., May 15.

A near view of Krakatoa in eruption.

In connection with the remarkable atmospheric wave, which, starting from Krakatoa at the time of the eruption, "travelled no less than three and a quarter times round the whole circumference of the earth,"[1] the following extracts from the log of a vessel sailing in the close vicinity of Krakatoa may be of interest:—

Extracts from log of barque William H. Besse, from Batavia towards Boston.

Aug. 26. — This day commences with light airs and calms. Light airs throughout the day. At 5.30 P.M., wind hauling ahead, let go starboard anchor with thirty fathoms chain, clewed up and furled all sail. Adam light bore W. 1-4 S. and E. by S. Throughout the afternoon and night, heard heavy reports, like the discharge of heavy artillery, sounding in the direction of Java Island. Very dark and cloudy throughout the night, with continual flashes of lightning. Barometer 30.15.

Aug. 27. — Commences with strong breezes, and thick, cloudy weather. Barometer 30.12. At 9.30 A.M., pilot left ship. Hove the lead every fifteen minutes. At daylight noticed a heavy bank to the westward, which continued to rise; and, the sun becoming obscured, it commenced to grow dark. The barometer fell suddenly to 29.50, and suddenly rose to 30.60. Called all hands, furled every thing securely, and let go the port anchor with all the chain in the locker. By this time the squall struck us with terrific force, and we let go starboard anchor with eighty fathoms chain. With the squall came a heavy shower of sand and ashes, and it had become by this time darker than the darkest night. *The barometer continued to rise and fall an inch at a time.* The wind was blowing a hurricane, but the water kept very smooth. A heavy rumbling, with reports like thunder, was heard continually; and the sky was lit up with fork lightning running in all directions, while a strong smell of sulphur pervaded the air, making it difficult to breathe. Altogether, it formed one of the wildest and most awful scenes imaginable.

The tide was setting strong to the westward throughout the gale, at the rate of ten knots per hour. At 3 P.M. the sky commenced to grow lighter, although the ashes continued to fall. The barometer rose to 30.30, and dropped gradually to 30.14, when it became stationary. The whole ship, rigging and masts, were covered with sand and ashes to the depth of several inches.

Aug. 28. — Commences with light airs, and thick, smoky weather. Hove up starboard anchor, and hove short on port anchor. Dead calm throughout the day and night. Saw large quantities of trees and dead fishes floating by with the tide; the water having a whitish appearance, and covered with ashes. This day ends with a dead calm, and thick, smoky weather.

Aug. 29. — This day commences with calms, and thick, smoky weather. Made all sail throughout the day. Moderate winds, and thick, smoky weather. Passed large quantities of driftwood, cocoanuts, and dead fishes. At 8 P.M., passed Anjier,[2] and could see no light in the lighthouse, and no signs of life on shore. Furled all light sails, and stood under easy sail throughout the night. Day ends with moderate winds and cloudy weather. Barometer 30.14.

Aug. 30. — Commences with moderate winds and cloudy weather. At daylight made all sail with a fresh breeze from the westward. Found the water for miles filled with large trees and driftwood, it being almost impossible to steer clear of them. Also passed large numbers of dead bodies and fish. Kept a sharp lookout on the forecastle throughout the day.

[1] *Nature*, vol. xxx. p. 12.

[2] All except the foundation of the lighthouse was destroyed by the tidal wave.

At 10 A.M., sighted Java Head lighthouse; but the wind hauling ahead, we kept away, and went round Prince Island. Latter part, fresh breezes, and thick, smoky weather. Friday and Saturday, passed large quantities of ashes in the water. Saturday, crew employed in cleaning ashes off masts and rigging. Water had a green color.

The point of special importance in the above account is the record of the sudden barometric fluctuations, due to the great air-wave with which readers of *Science* are already familiar.

Accompanying the above extracts from the log, is a sample of the 'sand and ashes' which fell so thickly upon the rigging. It is of a light gray color, and harsh to the touch. It is essentially a pulverized pumice, by far the greater part of it consisting of fragments of volcanic glass. These fragments are sometimes twisted, but generally in flat, angular transparent scales, which are filled with minute bubbles, and, of course, are isotropic. Angular fragments and crystals of transparent plagioclase, occasionally showing the hemitropic striations, and giving bright colors in the polariscope, together with more irregular and rounded fragments of dark green and brown pyroxenic minerals, probably augite and hypersthene, are scattered very occasionally among the glass particles. Grains of magnetite, often well rounded, also occur, and may be picked out and examined separately by a magnet covered with tissue-paper.

The dust collected by Mr. Joseph Wharton, from snow which fell in the suburbs of Philadelphia on Jan. 22, and supposed by him to be of volcanic origin,[1] has been kindly submitted by him to the writer for examination. It is composed of particles of quartz, coal, cinders, vegetable matter, etc., among which are certain glassy hairs and rounded globules. These bear no resemblance to the angular glass fragments composing the Krakatoa dust, which is remarkably free from either filaments or globules; and the supposed volcanic glass particles in the Philadelphia dust appear to be of local origin, — from blast-furnaces, founderies, or the like.

For the vial of dust, and the extracts from the log, I am indebted to my friend, Rev. Wayland Hoyt, D.D., of this city. H. CARVILL LEWIS.

Philadelphia, May 27.

Professor Gill on assumptions of museum-keepers.

In a recent issue of *Science*, p. 615, my friend Professor Gill has made a rather savage attack upon another very good friend of mine, for which I feel in some degree responsible, since a remark in my review of the 'Voyage of the Challenger' has been taken by the former as a text for his phillipic. I have no desire to cross swords in argument with so skilful a dialectician as Professor Gill, and shall therefore be contented to make certain general statements.

1. The policy of Dr. Günther, as keeper of the zoölogical collections of the British museum, has, from the start, been an extremely liberal one, much more so than that of his predecessor. I know of no museum where facilities are more readily granted, the methods in the natural-history department and in the great library of the British museum being precisely similar. Any person known to the authorities may secure the use of a table in one of the laboratories, and may have specimens brought to him day after day, from morning till night, as fast as he can fill up and sign the requisitions. That this is so, I can testify from personal knowledge. Within the past eighteen months, I have known of seven ichthyologists, — three from the United States, one from Italy, one from France, one from Sweden, and one from Australia, — each of whom spent weeks in the museum, and had no specimens refused him. I have also known of several other American zoölogists who have been treated with equal courtesy. I may mention, in passing, that no person, not an officer of the museum, is ever allowed to work in a room by himself, no matter how well he may be known, — a precaution which I believe to be quite necessary, since privileges of this sort have in the past been shamefully abused. I might mention one instance, many years ago, in which the entire collection of alcoholic specimens in one group of vertebrates was badly mutilated by a series of coarse dissections, carried on, without the knowledge of the authorities, by a young student, now one of our most distinguished American zoölogists. I have heard the story from his own lips, as well as from Dr. Günther.

2. The Challenger fishes are not, as yet, turned over to the British museum, but are still under the control of the lords of the admiralty, by whom, through Sir Wyville Thompson, Dr. Günther was requested to prepare the report upon the ichthyology of the expedition. Dr. Günther, therefore, in my opinion, is perfectly right in retaining this collection under his own control until his report is completed, after which they will, no doubt, become the property of the British museum, and be open to inspection under museum rules. The distinction between Dr. Günther in the capacity of keeper of the zoölogical collections of the British museum, and Dr. Günther in the capacity of naturalist, engaged upon the Challenger report, should be carefully observed.

Professor Gill refers to a case in which a certain European ichthyologist has recently been refused the privilege of examining the Challenger collections. Not being in possession of all the facts in the case, I shall not attempt to explain it. This I do know, however, that, at the time referred to, the Challenger fishes were being moved, together with the natural-history collections of the British museum, from Bloomsbury to South Kensington, and were in large part packed in boxes, so that they were really inaccessible; but a portion of the collection was still upon a table in Dr. Günther's private office: and these specimens, as well as others in his own house, were freely shown by him to Dr. Bean and myself. I cannot doubt that the same privilege would have been extended to any other ichthyologist who had made any reasonable request for the use of the material. It should be remembered, however, that these collections were not worked up in any way, were neither catalogued nor labelled, and were held by Dr. Günther as a personal trust from the Challenger survey, and had not yet passed into his official custody.

The question as to the extent to which any specialist, charged with the duty of working up collections made by a government expedition, may reserve to himself, while engaged in the preparation of his report, the handling of the material, is one into which I do not wish to enter at present. Professor Gill is apparently of the opinion that some question of moral principle is involved, and that working naturalists should be communists in respect to the use of material. The only point which I desire at present to make is this, that Professor Gill has evidently been misinformed as to the manner in which Dr. Günther has administered his trust as custodian of the zoölogical collections in the British museum.

In conclusion, I desire to enter a serious protest against the bitter and unreasonable criticisms upon Dr Günther's work which have of late years so fre-

[1] *Science*, Feb. 1, 1884, p. 139.